Phono® Solar
SHARE THE SUN, POWER THE FUTURE!

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PHONO SOLAR TECHNOLOGY CO., LTD.

# Photovoltaic Module Installation Manual (UL)

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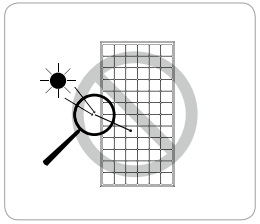
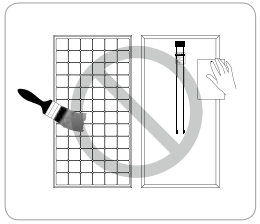
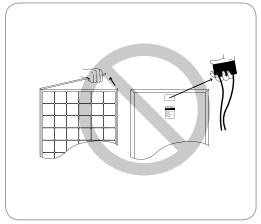


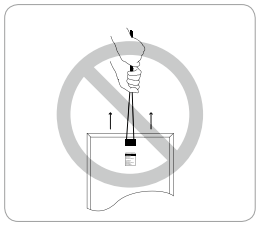
DO NOT use mirrors or magnifiers to concentrate sunlight onto the module.



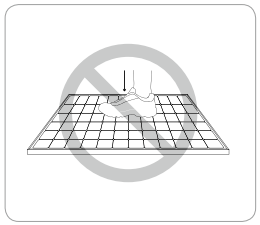
DO NOT paint the module or attach anything on to the back of the module.



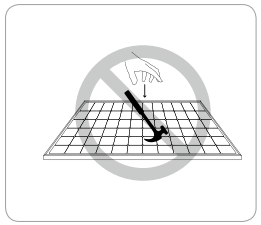
DO NOT attempt to disassemble the modules, and do not remove any attached nameplates or components from the module.



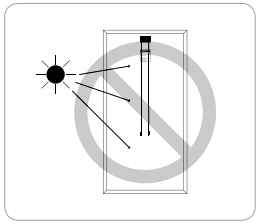
DO NOT lift or move the module by holding the junction box or cable.



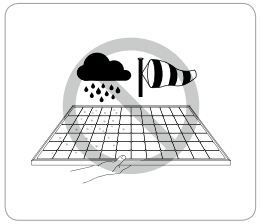
DO NOT place anything on the module or press on the module surface.



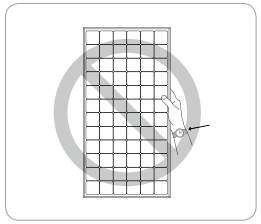
DO NOT drop the module or allow objects to fall on the module.



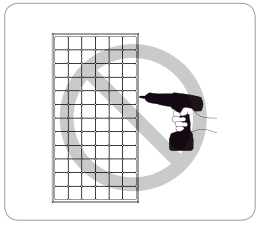
DO NOT expose the back of the module to direct sunlight.



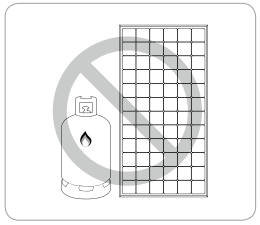
DO NOT install or handle module in wet or strong windy conditions.



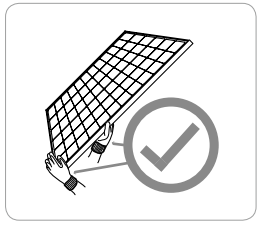
DO NOT wear metal ornaments while handling the module or during the installation.



DO NOT drill holes in the frame.



DO NOT use module near equipment or in places where flammable gases may be generated or collected.



Insulated gloves must be worn while handling the module and during the installation.

# ❶ IMPORTANT SAFETY GUIDE

This manual contains information regarding product identification and the safe installation and maintenance of photovoltaic modules (hereafter referred to as “module”) supplied by PHONO SOLAR TECHNOLOGY CO., LTD. (hereafter referred to as “PHONO SOLAR”). The term “module” can be interpreted as a single module or multiple modules depending on the context.

Installers must already be familiar with the mechanical and electrical requirements for a photovoltaic system. Installers must also read this manual carefully prior to installation. We recommend that you keep this manual in a safe place for future reference and in case of future sale or disposal of the module.

## 1.1 General Safety

- The installation of a photovoltaic system requires specialized skills and knowledge and must only be carried out by licensed/qualified persons.
- Installers should assume all risks of injury and do everything to avoid potential damages and risks that might occur during installation, including but not limited to, the risks of electric shock.
- PHONO SOLAR modules do not need special cables for connection. All of the modules have permanent junction boxes, cables and connectors.
- Do not use mirrors or magnifiers to concentrate sunlight onto the modules.
- The modules generate DC electrical energy from sunlight. They are designed for outdoor use and can be mounted onto frames on rooftops or in the ground etc.
- Do not paint the module or attach anything on to the back of the module.
- Do not attempt to disassemble the modules, and do not remove any attached nameplates or components from the modules.

## 1.2 Handling safety

- When handling the module insulated gloves must be worn.
- Inappropriate transportation and installation may break the module.
- Do not lift or move the module by holding the junction box or cable.
- Do not place anything on the module or press on the module surface.
- Do not drop the module or allow objects to fall on the module.
- Do not expose the back of the module to direct sunlight.
- Do not wear metal ornaments while handling the module.
- Do not install or handle modules in wet or strong windy conditions.

### 1.3 Installation safety

- Local, regional and state laws and regulations must be adhered to while installing a photovoltaic system. For example, any necessary licenses must be obtained prior to the installation commencing. Regulations around vehicles and ships must also be observed during the installation.
- Observe all safety rules for the other system components, including the cables, connectors, charging controllers, inverter and storage battery etc.
- Do not place the modules near a location where flammable gases are either generated or collected.
- Insulated gloves must be worn during the installation.
- Do not wear metal ornaments during the installation.
- Do not drill holes in the frame.
- Under normal conditions, a module is likely to produce more current and/or voltage than reported under Standard Test Conditions (STC). Accordingly, the values of Isc and Voc marked on the module nameplate should be multiplied by a factor when determining the component voltage ratings, conductor current ratings, fuse sizes, and the size of controllers connected to the photovoltaic system. The exact factor value should be suggested by a licensed/qualified person.
- The connecting ends with electricity may cause fire, spark or lethal shocks even when the modules are not connected.
- Electricity can be generated when the modules are exposed to sunlight, even if they are not connected. It is dangerous to touch 30V DC or higher, so never open the electrical connectors or unplug the electrical connectors while the circuit is under load, and do not touch the end with electricity during installations, when the modules are exposed to sunlight.
- Children should be kept away from the photovoltaic system.
- In order to prevent current and voltage generation during installation an opaque board can be used to cover the modules.
- Only use licensed/qualified insulated tools.
- The frame of the modules must be grounded according to local, regional and state safety and electrical standards. A recommended connector or equivalent must be used for the grounding cable. The grounding cable must be appropriately fastened to the module frame.
- Only Balance of System (BOS) in conformity to local, regional, state safety electricity standards and photovoltaic system such as connectors, cables and frames can be used, avoiding affect on the module performance and/or damage it.



### 1.4 Fire Safety

- Consult your local authority for guidelines and requirements for building or structural fire safety.
- Roof constructions and installations may affect the fire safety of a building; an improper installation may create a hazard in the event of a fire.
- Use components such as ground fault circuit breakers and fuses as required by the local authorities.
- Do not use the modules near a location where flammable gases are either generated or collected.
- The modules have been rated Fire Class C, and are suitable for mounting onto a Class A roof.

## ❷ PRODUCT IDENTIFICATION

On the back of each module there are 2 labels that provide the following information:

**Nameplate**: Describes the product type, rated power, rated current, rated voltage, open circuit voltage, short circuit current, all as measured under STC; weight, dimensions etc.; the maximum system voltage of 1000V DC.

***Warning: The value of Voc times the number of modules in series should not be bigger than the maximum system voltage marked in the nameplate.***

**Barcode**: This is used to identify each module. Each module has a unique and traceable serial number in the form of barcode. The barcode of each PHONO SOLAR module has 15 letter/digits.

***Warning: Do not remove the nameplate or barcode. The PHONO SOLAR product warranty will be void if either the module nameplate or barcode is removed.***

## ❸ MECHANICAL INSTALLATION

***(Note: All instructions hereafter are for reference only. A licensed/qualified person or installer must be responsible for the design, installation, mechanical load calculation and security of the photovoltaic system.)***

### 3.1 Select suitable locations for installation

- Select a suitable location for installing the modules.
- PHONO SOLAR recommends that to achieve the best performance the modules should face south in northern latitudes and north in southern latitudes. The exact tilt angle and orientation of mounted modules should be recommended by a licensed/qualified installer.

- The modules should be completely free of shade at all times.
- Do not place the modules near a location where flammable gases are either generated or collected.

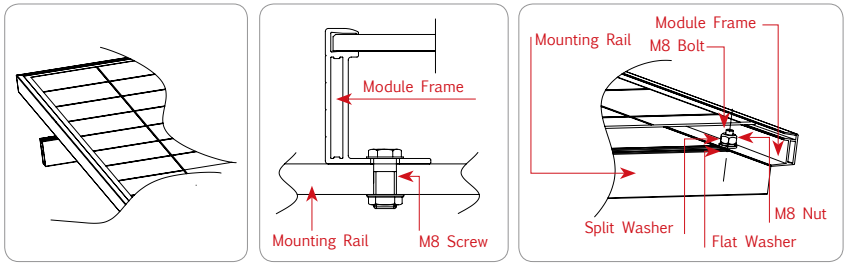
### 3.2 Select suitable mounting rails

- Please observe the safety regulations and installation instructions included with the mounting rail. If necessary please contact the supplier directly for further information.
- The modules must be safely set onto the mounting rail. The whole rail supporting the photovoltaic system must be strong enough to resist potential mechanical pressures caused either by wind or snow, in accordance with local, regional and state safety (and other associated) standards.
- Make sure that the mounting rail will not deform or affect the modules when it expands as a result of thermal expansion.
- The mounting rail must be made of durable, anti-corrosive and UV-resistant materials.

### 3.3 Select suitable mounting methods

PHONO SOLAR modules can be mounted using two methods:

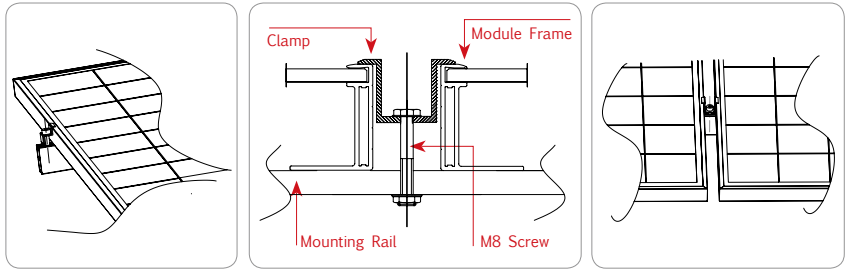
**Screw Fitting**: Use corrosion-proof screws in the existing installing holes in the module frame. Each module has 8 mounting holes for securing the module on the mounting rail. The module frame must be attached to a mounting rail using M8 corrosion-proof screws together with spring washers and flat washers in symmetrical locations on the module. The applied torque should be approximately 8Nm. Please find detailed mounting information in the below illustration:




*Module installed using Screw Fitting method*

**Clamp fitting**: Using suitable module clamps on the LONG side of the module frame to mount the modules is “portrait orientation” mode, while on the SHORT side of the module frame is “landscape orientation” mode.

The module clamps should not come into contact with the front glass and must not deform the module frame. Avoid any shadowing effects from the module clamps. The module frame can not be modified under any circumstances. Regardless of the orientation chosen, at least 4 clamps must be used on each module. For portrait orientation, 2 clamps should be attached to the long sides of the module and for landscape orientation 2 clamps should be attached to the short sides of the module. Depending on the local wind and snow loads, additional clamps may be required. The applied torque should be about 8Nm. Please find detailed mounting information in the below illustration:

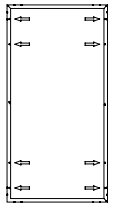
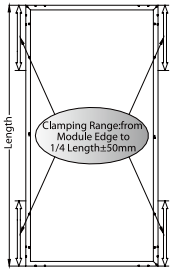
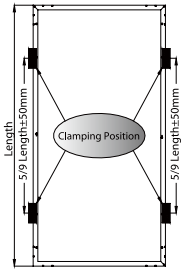
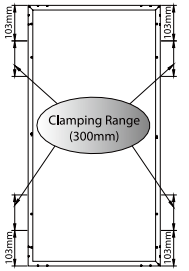
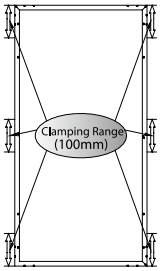
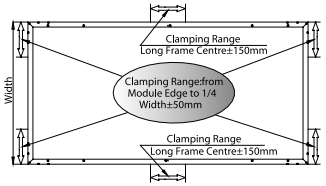
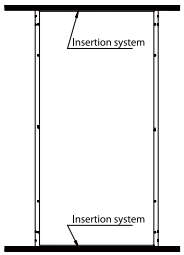
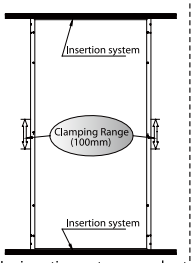
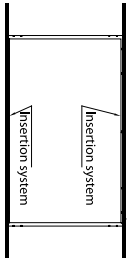



*Module installed using Clamp Fitting method*

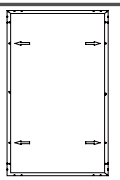
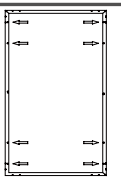
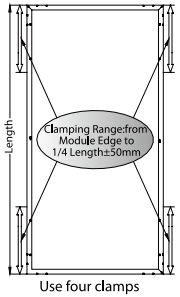
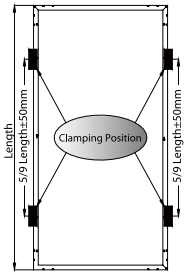
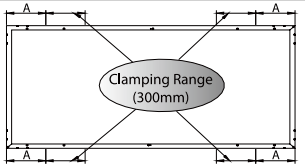
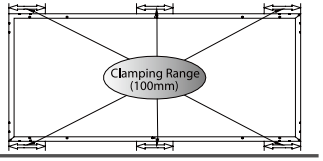
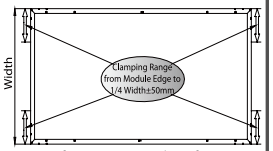
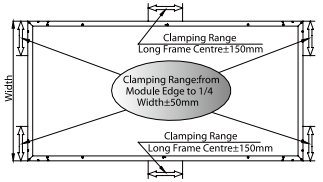
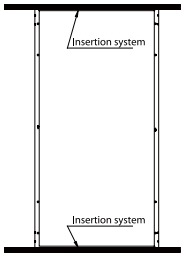
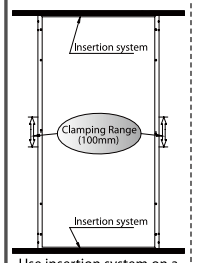
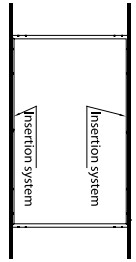
Select the appropriate installation method depending on the load (see below for more detailed information).

| | | |
|---|---|---|
| F Type | 1580mm x 808mm x 35/45mm | DIAMOND Series |
| | | ONYX Series |
| U Type | 1640mm x 992mm x 45mm | DIAMOND Series |
| | | ONYX Series |
| | | INTELLIGENT Series |
| T Type | 1956mm x 992mm x 50mm | DIAMOND Series |

## Phono Solar F Type module

| | 2400 Pa Load | 3800 Pa Load | 5400 Pa Load |
|---|---|---|---|
| **Mounting system** | | Use four mounting holes |  Use eight mounting holes |
| **Clamping system** Attachment to the long frame |   Use four clamps |   Use four clamps |   Use four clamps   Use six clamps |
| **Clamping system** Attachment to the short frame | | |  Clamping Range Long Frame Centre±150mm<br>Width<br>Clamping Range:from Module Edge to 1/4 Width±50mm<br>Clamping Range Long Frame Centre±150mm Use four clamps on the short frame and two clamps at the center of each long frame |
| **Insertion system** |   Use insertion system on short frame | |   Use insertion system on a short frame and two clamps at the center of each long frame   Use an insertion system on a long frame |

## Phono Solar U Type, T Type module

| | 2400 Pa Load | 3800 Pa Load | 5400 Pa Load |
|---|---|---|---|
| **Mounting system** | |  Use four mounting holes |  Use eight mounting holes |
| **Clamping system** Attachment to the long frame |   Use four clamps |   Use four clamps |   A(distance from module edge to clamping range) U series: 108mm   |
| **Clamping system** Attachment to the short frame |   Use four clamps on short frame | |  Clamping Range Long Frame Centre±150mm<br>Width<br>Clamping Range:from Module Edge to 1/4 Width±50mm<br>Clamping Range Long Frame Centre±150mm Use four clamps on the short frame and two clamps at the center of each long frame |
| **Insertion System** |   Use insertion system on short frame | |   Use insertion system on a short frame and two clamps at the center of each long frame   Use an insertion system on a long frame |

***Warning: Do not attempt to drill holes in the module frame or in the glass surface of the module. Any such modifications will void the PHONO SOLAR product warranty.***

**3.4** When installing a module on a pole ensure that the pole and mounting rail can withstand anticipated local winds. The pole must be installed on a hard base.

**3.5** Ensure that the installation height is such that the lowest modules will not be covered by accumulated snow or shaded by the surroundings.

**3.6** Ensure that there is adequate ventilation under the modules, conforming to local, regional and state standards and regulations.

**3.7** A minimum distance of 10cm, between the roof plane and the frame of the module is generally recommended.

**3.8** Observe the linear thermal expansion of the module frames. A minimum distance of 1cm between two modules is generally recommended.

## ❹ ELECTRICAL INSTALLATION

***(Note: All instructions hereafter are for reference only. A licensed/qualified person or installer must be responsible for the design, installation, mechanical load calculation and security of the photovoltaic system.)***

**4.1** Any hardware used must be compatible with the mounting material to avoid galvanic corrosion.

**4.2** Only use connectors that are designed for photovoltaic systems and that match PHONO SOLAR modules.

**4.3** When working with the connectors only use tools as recommended by the connector manufacturer.

**4.4** PHONO SOLAR recommends that the same type of modules are connected together in order to avoid any system power loss.

**4.5** The maximum number of series connected modules depends on system design, the type of inverter used and environmental conditions.

**4.6** Select insulated cables that are able to resist to ultraviolet radiation and extreme weather conditions.

**4.7** The rated voltage of the cable chosen must be appropriate to the overall maximum voltage of the system.

**4.8** The module frame must be grounded according to local, regional and state safety and electrical standards. Ensure that a recommended connector or equivalent is used for the grounding cable. The grounding cable must be properly fastened to the module frame.

## ❺ MAINTENANCE

In order to ensure optimum module performance, PHONO SOLAR recommends the following:

**5.1** If necessary, the glass front of the module can be cleaned with water and a soft sponge or cloth. A mild, non-abrasive detergent can be used to remove more stubborn stains.

**5.2** Check the electrical and mechanical connections periodically and make sure they are clean, safe, complete and secure.

**5.3** In the event of a problem, consult with a licensed/qualified person.

## ❻ GROUDING

**6.1** For grounding and bonding requirements, please refer to regional and national safety and electricity standards. If grounding is required, use a recommended connector type for the grounding wire.

**6.2** If grounding is required, make sure module frames (metal exposed to touch) are always grounded. Phono Solar recommends grounding of all module frames in order to ensure voltage between frames and ground is zero under all circumstances.

**6.3** Do not drill additional holes into the frame rails. The long frame rails have pre-drilled holes in their center marked with a grounding sign. These holes shall be used for grounding purposes and must not be used for mounting the modules to the support structure.

**6.4** Phono Solar recommends Wiley Electronics LLC “WEEB” components when grounding. Please refer to local supplier, installer or “WEEB” web site http://www.we-llc.com/weeb.html for more information.

## ❼ DISCLAIMER OF LIABILITY

Since it is impossible for PHONO SOLAR to control installation, operation, application and maintenance of the photovoltaic system according to this instruction, PHONO SOLAR does not accept responsibility and expressly disclaims liability for any loss, damage, or expense arising out of or in any way connected with such installation, operation, use or maintenance.

PHONO SOLAR will not take any responsibilities for any possible violation of patent rights and third party rights that are related to application of the solar energy system.

No permission of patents is given through implication.

The information of this instruction is from knowledge and experiences of PHONO SOLAR, and so it is reliable. However, the instructions and suggestions of this instruction do not make an external or internal of guarantee. PHONO SOLAR reserves the right to revise this instruction, products and all the information about products without prior notification to customers.



# Limited Warranty for PV-Modules

(Version EN_2012_V1)

Phono Solar Standard PV Modules with the Model Names covered under this warranty are:
PSXXXM-24/F (XXX = 180, 185, 190, 195,200,205,210)
PSXXXM-20/U (XXX = 230,235,240,245,250,255,260, 265,270)
PSXXXP-20/U (XXX = 230,235,240,245,250,255,260, 265)
PSXXXM-24/T (XXX = 280,290,300,310,320,330)
PSXXXP-24/T (XXX = 280,290,300,310,320,330)
The product (hereinafter the "Product") in this Warranty means the Standard PV Module(s) manufactured by Phono Solar Technology Co., Ltd. (hereinafter the "Phono Solar"). The Phono Solar warrants its Product(s) in compliance with the terms and conditions as stipulated below.
This "Limited Warranty for PV-Modules" is valid for all Standard Modules delivered from Phono Solar since 1st January 2012.

## ❶ Limited Product Warranty –Repair or Replacement

**Ten (10) years**

Phono Solar warrants that the Product including factory-assembled DC connectors and cables, if any, will be free from defects in material and workmanship under normal application, installation, operation, use and service conditions. If Product fails to conform to this warranty, within a period of ten (10) years from the date of delivery by Phono Solar to its first buyer (hereinafter the "Customer"), Phono Solar will, at its sole discretion, either repair the defective Product(s) at no charge; or replace the defective Product(s) or part thereof by a new or remanufactured equivalent at no charge, within the above specified period. This repair or replacement remedy shall be the sole and exclusive remedy provided under the "Limited Product Warranty" and shall not extend beyond the ten years period set forth herein.
This "Limited Product Warranty" does not warrant a specific power output, which shall be exclusively covered under clause 2 hereinafter ("Limited Peak Power Warranty").

## ❷ Limited Peak Power Warranty - Limited Remedy

**Twelve (12) years**

If, within a period of Twelve (12) years from the date of delivery by Phono Solar to the Customer any Product exhibits a power output less than 90% of the minimum "Peak Power at STC"1 as specified as of the Phono Solar's product label, provided that such

loss in power is determined by Phono Solar (at its sole and absolute discretion) to be due to defects in material or workmanship, Phono Solar will, at its sole option, either
(1) replace such loss in power by either (a) providing additional Product(s) to the Customer to make up for such loss in power or (b) replacing the defective Products(s) at the option of Phono Solar or
(2) refund the percentage of the cost of the Product(s) (as measured by the then prevailing market price for similar Product(s) to the Customer representing the percentage of the power output less than 90% the minimum "Peak Power at STC"1 as specified as of the Phono Solar's product label.
The remedies set forth in this clause 2 shall be the sole and exclusive remedies provided under the "Limited Peak Power Warranty".

**Twenty Five (25) years**

If, within a period of Twenty Five (25) years from the date of delivery by Phono Solar to the Customer any Product exhibits a power output less than 80% of the minimum "Peak Power at STC"1 as specified as of the Phono Solar's product label, provided that such loss in power is determined by Phono Solar (at its sole and absolute discretion) to be due to defects in material or workmanship, Phono Solar will, at its sole option, either
(1) replace such loss in power by either (a) providing additional Product(s) to the Customer to make up for such loss in power or (b) replacing the defective Products(s) at the option of Phono Solar or
(2) refund the percentage of the cost of the Product(s)(as measured by the then prevailing market price for similar Product(s) to the Customer representing the percentage of the power output less than 80% the minimum "Peak Power at STC"1 as specified as of the Phono Solar's product label.
The remedies set forth in this clause 2 shall be the sole and exclusive remedies provided under the "Limited Peak Power Warranty"

## ❸ Exclusions and Limitations

(1) In any event, all warranty claims must be received within the applicable warranty period for this warranty to be effective.
(2) The "Limited Product Warranties" and the "Limited Peak Power Warranties" do not apply to any Product(s) which have been subjected to:

- Misuse, abuse, neglect or accident;
- Alteration, improper installation or application;
- Non-observance of Phono Solar's installation manual;
- Impairments caused by external effects, such as e.g., dirt stains, smoke, damages caused by salt, by chemicals not explicitly authorized for use, e.g. for cleaning. Repair or modifications by someone other than an approved service technician of Phono Solar;
- Power failure surges, lightning, flood, fire, accidental breakage or other events out of Phono Solar' s control;
- Caused by external events including but not limited to defective equipment parts, appliances, system components like, connecting cables, invertors, or the like, which have been coupled with the Module by anyone other than Seller, or caused by defective system design, configuration, or installation planning;
- Removal of Modules and reinstallation at a new site;
- Installation on mobile platforms or in a marine environment; direct contact with corrosive agents or salt water; pest damage; or malfunctioning system components;
- Alteration, removal or obliteration of the original Module label;
- Other events that are reasonably beyond the control of Phono Solar.

(3) Both the "Limited Product Warranties" and "Limited Peak Power Warranties" do not cover any costs associated with installation, removal or re-installation of the PV-modules and (except as explicitly set forth in the final paragraph of Section 5) customs clearance or any other costs for return of the Product(s); .
(4) Both the "Limited Product Warranties" and "Limited Peak Power Warranties" do not cover cosmetic blemishes associated with installation, or the normal wear and tear of Phono Solar Modules.

## ❹ Limitation of Warranty Scope

These warranties as set forth herein are expressly in lieu of and exclude all other warranties of any kind whatsoever, whether express or implied, including but not limited to warranties of merchantability, of fitness for particular purpose, use, or application, of non-infringement and all other obligations or liabilities on the part of Phono Solar, unless such other obligations or liabilities are expressly agreed to in writing signed and approved by Phono Solar to the broadest extent permitted by law.

Phono Solar shall have no responsibility or liability whatsoever for damage or injury to persons or property, or for other loss or injury resulting from any cause whatsoever arising out of or related to the Product(s), including, without limitation, any defects in the Product(s), or from use or installation. Under no circumstances shall Phono Solar be liable for any special punitive, incidental, or consequential damages, howsoever caused, including but not limited to loss of use, loss of profits, loss of production, or loss of revenues, arising, directly or indirectly from the sale or use of any Product(s), whether such claim is based on warranty, contract, negligence, strict liability or otherwise, Phono Solar' s aggregate liability, if any, in damages or otherwise, shall not exceed the invoice value as paid by the Customer, for the single unit of Product(s) involved. The rights and limitations herein shall leave unaffected any legal rights

existing under mandatory applicable laws.

## ❺ Obtaining Warranty Performance

If the Customer has a justified claim covered by this “Limited Warranties for PV Modules”, an immediate notification directly to Phono Solar shall be filed by mailing a registered letter in writing to the address of Phono Solar listed hereunder, or by, sending an email letter to the email account of Phono Solar Service Center listed hereunder within Ten (10) weeks after becoming aware of the circumstances which constitute a warranty case. Together with the notification, the Customer should enclose the following information:

- The name and address of the Customer
- The corresponding serial number of the Product(s)
- The date on which the Product(s) have been delivered and installed
- The pictures of the defective Module which show the defect and/or the pictures which show the shadowing situation at the installation location

The timely receipt of the notification by Phono Solar shall be decisive.

The return of any PV-modules will not be accepted unless prior written authorization for the return and evaluation of the claimed defect has been given by Phono Solar. To the extent necessary for processing the return request Phono Solar or its authorized person shall be given commercially reasonable access to the Product(s) for inspection and analysis of the claimed defect. In connection with both the “Limited Product Warranties” and “Limited Peak Power Warranties”, Phono Solar shall reimburse Customer for reasonable, customary and documented transportation charges by sea freight for both the return of the Product(s) and reshipment of any repaired or replaced Product(s), only if this cost is authorized by Phono Solar customer service department.

## ❻ Severability

If a part, provision or clause of this “Limited Warranty for PV-Modules”, or the application thereof to any person or circumstance, is held invalid, void or unenforceable, such holding shall not affect and shall leave all other parts, provisions, clauses or applications of this “Limited Warranty for PV-Modules”, and to this extent such other parts, provisions, clauses or applications of this “Limited Warranty for PV-Modules” shall be treated as severable.

## ❼ Disputes

In case of any discrepancy in a warranty-claim, a first-class international test-institute such as Fraunhofer ISE in Freiburg/ Germany, TÜV Rheinland in Cologne/ Germany or ASU Arizona State University shall be involved to judge the claim finally. All fees and expenses shall be born by the losing party, unless otherwise awarded. The final explanation right shall be borne by Phono Solar.

## ❽ Various

The repair or replacement of the Product(s) or the supply of additional Product(s), does not cause the beginning of new warranty terms, nor shall the original terms of this “Limited Warranty for PV-Modules” be extended. Any replaced Product(s) shall become the property of Phono Solar made for their disposal. Phono Solar has the right to deliver another type (different in size, color, shape and/or power) in case Phono Solar discontinued producing the replaced Product(s) at the time of the claim.

## ❾ Warranty Transfer

This warranty is transferable from the original Customer to any assignee and remains in effect for the time period remaining under the limited warranties, provided the Product remains installed in its original location at the warranty registration.

## ❿ Force Majeure

Phono Solar shall not be responsible or liable in any way to the customer or any third-party arising from any non-performance or delay in performance of any terms and conditions of sale, including this "Limited Warranty for PV-Modules ", due to acts God, war, riots, strikes, warlike conditions, plague or other epidemics, fire, flood, or any other similar cause or circumstance beyond the reasonable control of such Phono Solar. In such cases, performance by Phono Solar of this Limited Warranty shall be suspended without liability for the period of delay reasonably attributable to such causes.

1 “Peak Power at STC” is the power in Watt peak that a PV- Module generates in its Maximum Power Point.
“STC” are as follows:
light spectrum of AM 1.5, (b) an irradiation of 1000 W per m2 and (c) a cell temperature of 25 degree centigrade at right angle irradiation.
The measurements are carried out in accordance with IEC 61215 as tested at the connectors or junction box terminals – as applicable – per calibration and testing standards of Phono Solar valid at the date of manufacture of the PV-modules. The power output shall be measured by a laboratory approved by Phono Solar.